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CHEMISTRY SUPPLEMENT



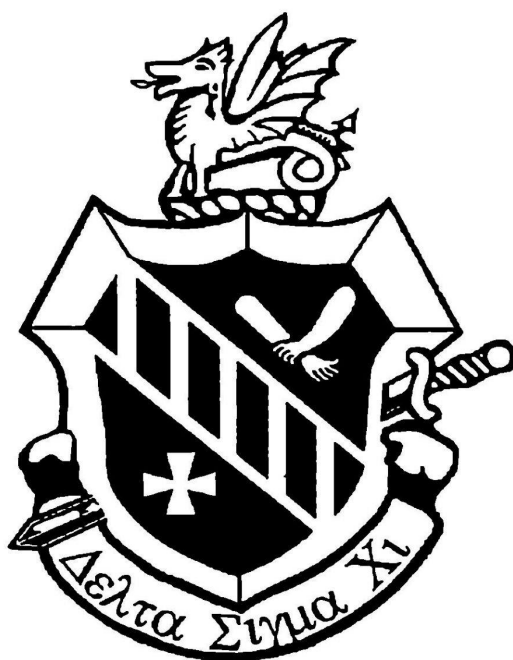
By S. J. BURICH



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CHEMISTRY SUPPLEMENT



By S. J. BURICH



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AUTHOR'S PREFACE

THIS little pamphlet should be used in connection with Chiropractic Chemistry as a guide to study and as a supplement to that text. I am not unmindful of the fact that chemistry to many of us is a difficult subject, and one which is sometimes approached by the student with a lack of confidence because of the unusual terms which are associated with it.

It is for this reason that I am producing this little booklet. In it there will be found outlines which will make clear many points which heretofore have seemed complex. The definitions contained will also be advantageous in gaining a clearer concept of the subject. And finally there has been incorporated a system of questions with page references which will enable the student to gain a clearer understanding of the entire subject matter.

I wish to extend all credit for this appendage to C. C. Hall and C. A. Russell, who have so ably carried on the work of its compilation. Because these men teach chemistry in the various classes, they are familiar with just what points should be covered and the proper manner of covering them; and I feel that the student of Chemistry will be as grateful to these teachers as I myself am, because of their generous efforts to the end of simplifying this subject.

S. J. BURICH.

CHEMISTRY REVIEW

INORGANIC CHEMISTRY

Definitions

1. **SCIENCE** is accumulated and accepted knowledge, systematized.
2. **CHEMISTRY** is the natural science which treats of the composition of matter.
3. **MATTER** is anything that has length, breadth and thickness, or anything that occupies space.
4. **AN ELEMENT** is a substance that cannot be split up, by any known means, into anything but itself.
5. **A COMPOUND** is a substance composed of two or more elements chemically united.
6. **AN ATOM** is the smallest quantity of an element that can enter into chemical combination.
7. **A MOLECULE** is the smallest quantity of a substance (either element or compound) that can exist in the free state.
8. The **ATOMIC WEIGHT** of an element is the weight of one of its atoms compared to the weight of one atom of Hydrogen.
9. The **MOLECULAR WEIGHT** of a substance is the weight of one of its molecules compared to the weight of one atom of Hydrogen.
10. **ANALYSIS** is the breaking down of compound bodies into simple constituents (compounds into elements or simpler compounds).
11. **SYNTHESIS** is the process of building up compound bodies from elements or simpler compounds.
12. **VALENCE** is the combining power of one atom of an element as compared to the combining power of one atom of Hydrogen.
13. **A SYMBOL** is a chemical shorthand expression, or abbreviation, for an element (represents one atom of the element).
14. **A FORMULA** is a combination of symbols, representing a molecule, and shows the kind and number of atoms of which it is composed.
15. **A CHEMICAL EQUATION** is an expression of chemical action (chemical change) by means of symbols, numbers and signs.
16. **REACTION** is a term applied to chemical action (chemical change) and also to the action of a substance upon certain organic pigments.
17. **AN OXID** is a compound containing Oxygen alone as its negative radicle.
18. **VOLUME** is the space occupied by a certain amount of matter.

19. **PRECIPITATION** is the change from a dissolved to an undissolved (solid) state.

20. A **REAGENT** is a substance capable of producing a reaction (chemical change).

21. **COMBUSTION** is a chemical process, usually union with Oxygen, accompanied by flame.

22. **OXIDATION** is the process of combining an element with Oxygen, or of increasing the proportion of Oxygen in a compound.

23. **REDUCTION** is the process of removing Oxygen (all or part) from a compound.

24. **AN ALLOY** is a physical mixture of two or more metals.

25. **AN AMALGAM** is an alloy which contains Mercury.

26. A **METAL** is an elementary, positive substance capable of conducting heat and electricity.

27. **AN ACID** is a compound composed of the positive element **Hydrogen** united to a negative element or radicle.

28. A **SALT** is a compound of a positive element (not Hydrogen) united to a negative element or radicle.

29. A **BASE** is a compound composed of a positive element (not Hydrogen) united to the negative hydroxid radicle.

30. A **COEFFICIENT** is a number (written large) before a formula to indicate the number of molecules.

31. **AN EXPONENT** is a number (written small) below and behind a symbol to indicate the number of atoms of such element.

32. A **MALLEABLE** substance is one that can be hammered or rolled into thin sheets.

33. A **DUCTILE** substance is one that can be drawn out into a fine wire.

34. **ALLOTROPY** is the property which some elements possess of occurring in more than one form. The physical properties of the different forms vary greatly; the chemical properties slightly, or not at all.

35. A **REDUCING AGENT** is one that is capable of removing Oxygen from compounds.

36. **AN OXIDIZING AGENT** is one that is capable of imparting Oxygen to some substances.

37. **THE THREE STATES OF AGGREGATION OF MATTER**

SOLID—such as ice, coal, iron, etc.

(A solid has independent, or definite, volume and shape. It occupies a definite amount of space and its shape is not influenced by the shape of the containing vessel.)

LIQUID—such as water, oil, mercury, etc.

(A given portion of a liquid has definite volume, but not definite shape; its shape is influenced or controlled by the shape of the containing vessel.)

GAS—such as steam (water vapor), air, oxygen, etc.

(A gas has neither definite volume or shape; as for volume, it tends to expand indefinitely; as for shape, it completely fills any closed container and so takes the exact shape of the container.)

The science of Chemistry is divided into two divisions, **Organic Chemistry**, or the study of the element Carbon and its compounds; and **Inorganic Chemistry**, the study of all other elements and their compounds.

Some few compounds containing carbon are usually included in the study of Inorganic Chemistry, but the greater number are left for consideration under Organic Chemistry.

INTRODUCTION

The full scope of the subject of Chemistry is the study of the composition of everything and anything material in the universe. At first the magnitude of this task appears appalling, but it is wonderfully simplified when we learn that all matter is composed of ninety-two individual, separate substances called elements. Anything material is found to be composed of one or several elements. Therefore, if we can learn all about each one of these elements, all about the various forms, mixtures and compounds in which each occurs, or can be made to occur, we will have a full, complete knowledge of the composition of matter.

We shall simplify the subject further by confining our study principally to the thirty or thirty-five elements which make up the most common, familiar and important substances in our modern, everyday, civilized life.

ELEMENTS (See Definition)

Iron, then, is an element, because pure iron cannot be broken down or torn apart by any means and separated into two or more other substances. Iron, if pure, is nothing but iron. Several different things or substances are not combined, or mixed, to produce iron. It is one, single thing or substance.

Water can be shown to be composed of Hydrogen and Oxygen. It is divisible into two separate, distinct substances, each different from water. Water, therefore, is not an element. Hydrogen and Oxygen, which are **not** further divisible or separable into two or more constituent parts, are elements.

There are two great classes or kinds of elements, based on their physical properties, or appearance, and every element falls into one or the other of these two groups: **METALS** and **NON-METALS**. Many of the former and a few of the latter are already known to us.

METALS

Metals, as a group, possess the following characteristics to a greater or lesser degree. With the single exception of Mercury, they are all **solids** at ordinary temperatures. With the exception of Gold or Copper, they are all of about the same **silvery-gray color**, when pure and untarnished. They are all at least **comparatively malleable and ductile**, not brittle. They are **conductors** of

heat and electricity and exhibit a lustrous, shining, mirrorlike surface when polished.

Some of the more important metals are Sodium, Potassium, Silver, Calcium, Barium, Magnesium, Zinc, Lead, Copper, Tin, Iron, Gold, Mercury and Aluminum.

NON-METALS

The members of this group of elements are distinguished, not so much by a general uniformity of physical properties, but rather by a lack of such uniformity, and also by a general lack of all, or nearly all, of the characteristics of the metals. As to state of aggregation, we find gases, both colored and colorless, a liquid, and various colored solids. Most of them are non-conductors, or poor conductors, of heat and electricity; brittle rather than malleable or ductile. A tabulation and brief description of the more important non-metals includes

Hydrogen—colorless gas.

Oxygen—colorless gas.

Nitrogen—colorless gas.

Chlorin—greenish-yellow gas.

Fluorin—greenish-yellow gas.

Bromin—reddish-brown liquid.

Iodin—dark-gray crystal plates.

Sulphur—yellow solid.

Phosphorous—yellow translucent, waxlike solid.

Arsenic—gray lustrous, crystal solid.

Carbon—solid, usually black.

Silicon—hard crystal solid.

PHYSICAL AND CHEMICAL CHANGE

It is a fundamental principle, or axiom, of chemistry that matter is indestructible. It can neither be created nor destroyed. Under some conditions matter (the elements which compose it) is subject to profound changes, but it cannot be annihilated. Substances may apparently disappear, are apparently destroyed, but this is apparent and not real. For example: The wax of a burning candle slowly disappears from our sight. Apparently its substance is destroyed. Close examination, however, discloses the formation of colorless gases at the burning surface of the candle, invisible because colorless, but existent and real just the same. If all these gases are collected and weighed, their mass will be found to be not only equal to that of the candle originally, but actually **greater**. What has happened? The elements constituting the wax of the candle have combined with some of the element Oxygen present in the air of the room to form new substances (carbon dioxide gas and water vapor), devoid of color, but still material. **Every particle of every element** originally in the wax or wick of the candle still exists, either as a residue in the candlestick or as a constituent of gases in the air of the room.

Let us further consider other changes in matter. A piece of pure Iron is placed in a foundry furnace. Several changes take

place. It is heated. A change (elevation) in temperature. It becomes successively red, yellow and white. Changes in color. It becomes a fluid, a change in the state of aggregation from a solid to a liquid. These several changes take place when Iron is heated.

Another piece of Iron is exposed to the action of the air and moisture. It becomes rusty, at first a few flakes on the surface, finally the whole surface, and eventually throughout the whole mass. Finally Iron as we knew it originally has disappeared and there remains nothing but rust. Here several changes have taken place also. A change in color from gray iron to reddish-brown rust. A change from malleable and ductile metallic Iron to brittle, crumbly rust. A cubic foot of Iron is 7.5 times as heavy as a cubic foot of water. A cubic foot of rust is but 4.5 times as heavy as the same volume of water. A change from Iron to a specifically lighter substance.

While we have noted several changes taking place in each of the two examples above, actually there are but two kinds of changes which can ever take place in matter. These are:

1. Changes in composition, called **chemical change**.
2. Changes that do not involve composition. All changes not chemical are called **physical changes**.

The first example, the heating of Iron, illustrates physical change only. The red or white hot Iron, either solid or liquid, is still Iron and nothing but Iron, as we can observe if we allow it to cool again. Obviously there has been no change in composition; we started with iron, we finished with Iron, the same substance, nothing else. This, then, must be **physical change**.

In the second example, the rusting of Iron, we find that not only has there been a change in color, not only a loss of malleability and ductility, and a substitution of brittleness, not only a change to a specifically lighter substance, but also a further change.

We exposed the **element Iron**, a single kind of matter, to the action of air and moisture. If we examine the composition of the rust formed we find it to be made up of **Iron and Oxygen**. The two elements combined make up its composition and this change, involving the change in composition from a substance composed of Iron alone to a substance composed of the two elements, Iron and Oxygen, is a change in composition. It is a **chemical change**.

The substance water exists in the three states of aggregation: Ice, water and vapor, or steam. All have exactly the same composition, being made up of the two elements, Hydrogen and Oxygen. The change from ice to water, water to steam, and vice versa, is **physical change**. There is no change in composition. Magnetizing iron is another example of physical change. No change in composition.

The combustion of coal is a **chemical change**. The free element, Carbon, is united with the element Oxygen (from the air) to form a new substance, the gas Carbon Dioxide.

We study three distinct forms of chemical change, namely, re-

arrangement, combination and decomposition. **Rearrangement** refers to the formation of new compounds by a combination of the same substance in different ways. **Decomposition** is the separation of a body into new substances and constitutes chemical analysis. **Combination** is the union of bodies to form new substance and is rightly termed synthesis.

COMPOUNDS

A **compound** is a substance composed of two or more elements chemically united, and must be distinguished from a simple (physical) mixture of elements. There are two outstanding characteristics which enable us to make this distinction with comparative ease.

First—Compounds seldom, almost never, resemble in appearance the elements of which they are made up. The individual elements of which they are composed cannot be recognized as such—their identity has been lost.

Second—A compound is always made up of a certain, definite, exact proportion of the constituent elements, whereas it is obvious that in a mixture we can have any proportion, or quantity, of any of the constituent elements, which we desire.

The case of the two elements, Iron and Sulphur, which may be either mixed or united in a chemical compound, will serve to illustrate the two above points.

If fine Iron filings and powdered Sulphur are carefully ground together in a mortar, the product is a physical mixture only, of the two elements. It is true that this mixture has a slightly different color than either of the two component elements, but it can be readily demonstrated that it is made up of the two elements, each distinct, though in intimate juxtaposition. By the use of a needle and a magnifying glass the two elements can be separated completely. Surely this is sufficient evidence to demonstrate that they were only mixed. Further, however, if a magnet is brought in contact with the mixture, it will attract and remove the particles of Iron, but will have no effect on the Sulphur particles. In this mixture the individual elements can be easily identified and there is not necessarily any constant ratio of proportion between them. Such a substance cannot be a compound.

For the purpose of forming a compound between these two elements there is taken fifty-six parts by weight of Iron and thirty-two parts by weight of Sulphur (the reason for this proportion will be seen later). After thoroughly mixing, the mass is placed in a hard glass test tube, and heat applied to the outside. Soon the mass begins to glow, apparently a kind of combustion is taking place. Even though the outside source of heat is removed, the glowing persists for some time. When it finally cools, there is found a somewhat porous-looking, black, brittle, solid mass, entirely different from the dirty, grayish-looking mixture of Iron and Sulphur. Examination with a strong magnifying glass does not reveal the presence of any individual particles of either Iron or Sulphur. No part of the mass is affected in any way by man-

ipulation with a magnet. The substance is not magnetic and no Iron can be withdrawn from it by this means. This new black substance is known to chemists as Iron (ferrous) Sulphid. It is a compound, not a physical mixture. It is composed of Iron and Sulphur, and nothing else, but it is not like either in appearance. The composing elements have lost their elemental properties. They are present in a definite, exact proportion.

All of the known elements, except five, form compounds with at least some of the other elements. All matter is composed of elements existing alone and free, in compounds, or in mixtures.

Chemical change is a well-ordered affair, and although some occurrences cannot be explained, this is because our knowledge is not sufficient, rather than because of the failure of substances to act according to natural laws.

POSITIVE AND NEGATIVE ELEMENTS

In studying compounds it is found desirable to make a two-group classification of the elements slightly different than the **Metallic** and **Non-Metallic** grouping.

When the two wires from a battery or dynamo carry an electric current through solutions of various substances, it is found that some elements are attracted to one of the electric wires and other elements to the other wire. In general it may be stated that all the metals, and Hydrogen, will be attracted by the negative electric wire and that all the non-metals, except Hydrogen, will be attracted by the positive electric wire. It is a law of electrophysics that likes repel and unlikes attract. So the elements attracted to the positive wire (all the non-metals, except Hydrogen) are called **Negative elements**, and the metals, with Hydrogen, being attracted to the negative wire are called **Positive elements**. This is particularly important because it will be seen later that under certain conditions negative elements form one kind of compounds and under exactly the same conditions positive elements form different kinds of compounds. The positive elements, then, include all the metals and Hydrogen; the negative elements include all the non-metallic elements except Hydrogen.

ATOMS, MOLECULES, AND ATOMIC WEIGHT

(See Definitions)

An element is made up of atoms, which are the smallest portions of an element that can exist in a compound. Individual atoms (with few exceptions) cannot exist alone. In compounds they adhere to atoms of other elements. In an element, then, other atoms of the same kind keep them company.

To the smallest portion of a substance, either an element or compound, which can exist separate from all other matter, we apply the term **molecule**. A molecule of an element is composed of atoms, all alike; a piece of pure Iron is composed of molecules of Iron and these molecules in turn are composed of atoms of Iron.

A molecule of a compound is composed of two or more different kinds of atoms. A molecule of the compound Iron Sulphid is composed of one atom of Iron united to one atom of Sulphur. A mixture of Iron and Sulphur is composed of molecules of Iron and molecules of Sulphur. Atoms of Iron have not united to atoms of Sulphur in the mixture. Compounds are formed by the union of atoms of different elements.

The atomic weight of an element is the weight of one of its atoms compared to the weight of one atom of Hydrogen. Hydrogen is the lightest substance. The atom of Hydrogen is lighter than the atom of any other element. Therefore, if the weight of one atom of Hydrogen is taken as one (unity) the atomic weight of all the other elements will be greater and there will be no fractions, of less than one, to deal with.

An atom of Hydrogen will unite with one atom of Chlorine to form one molecule of a compound (hydrochloric acid). An atom of Fluorin, Bromin, or Iodin will also combine with one atom of Hydrogen to form a molecule of a compound. But to form a compound with one atom of Oxygen it is found that two atoms of Hydrogen are required for the new molecule. The same is true of Sulphur; one of its atoms insists on having two Hydrogen atoms to mate up with before it will condescend to form a molecule of the compound of the two elements. An atom of phosphorus requires three of Hydrogen.

VALENCE

Valence is the combining power of one atom of an element compared to the combining power of one atom of Hydrogen. Therefore we see that the number of atoms of Hydrogen (or other univalent element) with which an atom of a given element combines determines the valence of the latter. Hydrogen, then, is the standard of both valence and atomic weight.

Under various conditions the valence of some elements is subject to change, but the majority of them have a most common valence of paramount importance.

Hydrogen is always univalent; Fluorin, Bromin, Chlorin and Iodin almost always. Oxygen is almost always divalent, but it is in compounds with this element that the valence of many others is most subject to variation.

The following is a table of the valence of the most important elements, to be substituted for table Page 24 of text:

+Monads	+Diads	+Triads	—Monads	—Diads	—Triads	—Tetrads
K	Ba	Al	F	S	P	C
H	Mg	Bi	Cl	O	N	Si
Na	Mn	Sb	Br		As	
Ag	Sn		I			
	Zn					
	Cu					
	Pb					
	Fe					
	Hg					
	Ca					

RADICLES

Every inorganic chemical compound may be considered to be composed of two parts, each of these parts being called a radicle. Just as elements are divided into the two groups, positive and negative, radicles are separated into two classes, also called positive and negative. It follows, then, that if a compound is composed of but two elements (one positive and one negative), then one of these elements is the positive radicle, or part, and the other is the negative radicle. It must be noted, too, that frequently two negative elements unite to form a compound, in which case the more intensely negative of the two is the negative radicle, and the weaker negative becomes for the time being a positive radicle (not changing from a positive to a negative element, however). Oxygen is the most extremely negative of all elements, and whenever it is found in a compound of two elements it constitutes the negative radicle. Thus in compounds such as CO_2 , N_2O_5 , Oxygen forms the negative radicle as well as in such compounds as Na_2O , CaO , ZnO .

When three elements are united, forming a compound, it is obvious that one of the radicles must be composed of two elements. We have then two kinds of radicles, based on the number of elements present. A single element, forming a part of a compound as a radicle, is called a SIMPLE RADICLE. A radicle made up of two or more different elements is called a COMPOUND RADICLE. It is to be noted that when two or more elements in a group make up a compound radicle they behave much like a single element as a part of a compound, and exhibit great persistency in retaining their group union as a radicle, even to the point of passing from one compound to another without losing this group union.

A radicle is a root, characterized by an atom, or a group of atoms, running through a series of compounds like the root words in a language. A single atom which forms a series of such compounds is called a simple radicle. A compound radicle is a group of atoms running through a series of compounds and acting as a single atom. That is, radicles enter or leave compounds the same as individual atoms.

The valence of a simple radicle is, of course, the valence of the element and, as has been noted before, is in some cases subject to change, but in general is fairly uniform and constant.

The valence of compound radicles is determined in exactly the same way that the valence of simple radicles is found, by comparing the combining power of the compound radicle with the combining power of an atom of a univalent element, preferably Hydrogen, the standard of valence.

This is the only reliable method of obtaining the valence of the compound radicle and the student should not attempt to arrive at it from the differences in the valence of the constituent elements. This because most of the compound radicles contain Oxygen, and it is in compounds with Oxygen that the valence of other elements is most subject to change. A compound radicle

may be defined, however, as a group of atoms having an unsatisfied valence.

In inorganic chemistry there are a great many negative compound radicles and very few important compound radicles which are positive. Most of these negative compound radicles can and do unite with the positive element (radicle), Hydrogen, to form a group of compounds known as acids. Since Hydrogen is the standard of valence, if the composition, or formula, for the acid containing a compound radicle is known, the valence of the radicle is immediately evident. Experience in teaching has shown that the easiest and best way to progress in the study of chemistry is to learn the formulas for the more common acids, which immediately gives familiarity with the more important compound radicles and their valences. Then the substitution in such formulas of other positive elements for Hydrogen, according to the valence, opens up the knowledge of the composition of a great number of compounds.

Sulphuric Acid has the formula H_2SO_4 . The positive radicle Hydrogen is united to the negative SO_4 radicle. This compound negative radicle must have a valence of two because it is united in a true compound to two atoms of H, the standard of valence. The formula for the compound of Sodium and the SO_4 radicle is Na_2SO_4 , as Sodium, like Hydrogen, is univalent. With the bivalent element Zinc, the SO_4 radicle forms the compound ZnSO_4 in which its double valence is satisfied by one atom of zinc. The SO_4 radicle is called the sulphate radicle and the sulphate of any metal has the formula made up as illustrated above.

The following is a table of the important acids containing compound negative radicles:

Acid	Name	Radicle	Radicle Name	Radicle Valence
HNO_3	Nitric Acid	(NO_3)	Nitrate	I
HClO_4	Chloric Acid	(ClO_4)	Chlorate	I
H_2SO_4	Sulphuric Acid	(SO_4)	Sulphate	II
H_2CO_3	Carbonic Acid	(CO_3)	Carbonate	II
H_3PO_4	Phosphoric Acid	(PO_4)	Phosphate	III

GENERAL PROPERTIES OF THE PRINCIPAL CLASSES OF COMPOUNDS

(To be substituted for text pages 42 to 50)

Elements unite to form compounds along systematic lines, and though the individual compounds will be considered when each element is treated separately, it is desirable to make a preliminary survey of the main classes of compounds showing the outstanding properties of each. This will serve to summarize many of the principles of chemical change and provide a rough, but practical, plan of chemistry.

The ending "id" is equivalent to the phrase "nothing else," and means that nothing else is contained in the combination except that which is expressly mentioned. Hydrogen Sulphid (H_2S), as the name indicates, contains nothing but Hydrogen and Sulphur; Sodium Chlorid (NaCl) contains nothing but

Sodium and Chlorin; Potassium Bromid (KBr) contains only Potassium and Bromin.

The word "of" is used in many of the older works on chemistry, and then instead of Hydrogen Sulphid, the phrase "sulphid of hydrogen" is used; in place of saying Sodium Chlorid, "chlorid of sodium."

Many compounds, though composed of just exactly the same elements, possess the peculiarity of combining in several different proportions.

With but very few exceptions, all inorganic compounds can be classed into one of the four groups—acids, bases, oxids and salts.

ACIDS. The literal meaning of acid is a sour substance. Chemically an acid is a compound composed of the positive radicle Hydrogen united to a negative radicle (except O or OH). The negative radicle may be either elemental as in HCl or compound as in HNO₃. Acids are sour in taste, corrosive in action, always possess Hydrogen as the positive radicle, and have the property of turning blue litmus, or other blue vegetable dyes, red. This last property of acids is commonly known as the acid reaction.

There are two main classes of acids, known as the hydro (Hydrogen) and oxy (Oxygen) acids. **Hydro acids** are acids which contain no Oxygen, and though many such exist, there are six commonly known as the **hydro acids**, composed of Hydrogen united to a negative element, or radicle, which contains no Oxygen. Following are the six important acids which belong to this group:

HCl — Hydrochloric acid.

HBr — Hydrobromic acid.

HI — Hydriodic acid.

HF — Hydrofluoric acid.

HCN — Hydrocyanic acid.

H₂S — Hydrosulphuric acid, or hydrogen sulphid.

The above acids are named by using the name of the negative element, or radicle, with the prefix "**hydro**" to denote the absence of Oxygen, and the suffix "**ic**."

Hydrogen Sulphid is such an extremely weak acid that some chemists prefer not to call it an acid at all, but it does possess the acid properties to a very slight degree. Water (H₂O), however, is not sour to the taste; is not corrosive to most substances, and does not turn blue vegetable dyes red, so while by definition it should be a hydro acid, since its properties are entirely different, it is not so considered.

By far the greater majority of acids belong to the second class and contain Oxygen. These "**oxy**" acids are divided into groups or families and are then named by the use of certain prefixes and suffixes, together with the name of the middle (negative) element. For example: Chloric Acid HClO₃ is the most common and most important "**oxy**" acid containing Chlorin. The other "**oxy**" acids containing chlorin are named as follows:

HClO₃ — Chloric acid. HClO₂ — Chlorous acid.

HClO — Hypochlorous acid.

The most common acid of the family takes its name from the middle element, with the suffix "ic." The one containing the next lesser quantity of Oxygen has the suffix "ous" in place of "ic." The one next lower than "ous" in Oxygen content keeps this suffix, but has the prefix "hypo." It may be seen, then, that the relative amount of Oxygen determines the name of the acid, and if we know the formula for the most common acid of the family, the formulas and names of the others may be secured by following the above system. For example:

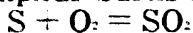
H_3PO_4 — Phosphoric acid.

H_2PO_3 — Phosphorous acid.

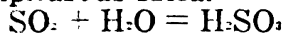
H_2PO_2 — Hypophosphorous acid.

Many oxy acids may be made by the addition of water to oxids of non-metals, also called acid oxids and acid anhydrids.

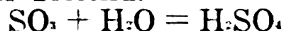
When Sulphur burns in air, Sulphur Dioxid is formed.



If the Sulphur Dioxid is conducted into water, the two unite to form Sulphurous Acid.



Sulphuric Acid, H_2SO_4 , may be formed by the union of water and Sulphur Trioxid.



In addition to the classification of acids as "hydro" or "oxy," according to the presence or absence of Oxygen in the molecule, another grouping of acids is made according to the number of Hydrogen atoms in the molecule. Thus Hydrochloric Acid, HCl , and Nitric Acid, HNO_3 , each containing but one Hydrogen atom in the molecule are both called **monobasic**. Carbonic Acid, H_2CO_3 ; Hydrosulphuric, H_2S ; Sulphuric, H_2SO_4 , and all acids which contain two Hydrogen atoms are called **dibasic**. Phosphoric Acid, H_3PO_4 , and all acids which contain three replaceable Hydrogen atoms, are called **tribasic**. This classification is entirely independent of the oxy and hydro, or non-oxy grouping.

Monobasic Acids

HCl HNO_3
 HBr HClO_3
 HF
 HI

Dibasic Acids

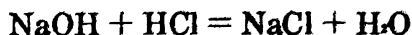
H_2S
 H_2SO_4
 H_2CO_3
 H_2SO_3

Acid formulas may be instantly recognized by the presence of the positive radicle Hydrogen. Absence of this radicle indicates that the compound is not an acid.

The most powerful and corrosive of the inorganic acids are commonly called the MINERAL ACIDS. They are HCl , H_2SO_4 , and HNO_3 .

BASES. Just as in other spheres of use the words base means a foundation, so in chemistry it indicates a substance capable of carrying different structures. In inorganic chemistry a base is a compound made up of a positive radicle (not H), usually a metal, united to the negative hydroxid (OH) radicle. Strong bases are corrosive, bitter to the taste, and are the diametric opposites of

acids. Whereas an acid turns blue litmus red, a base turns red litmus blue. This property of bases, of turning red litmus blue, is called the alkaline reaction, and sometimes bases are termed alkalis, particularly those bases which are soluble in water. A base is also defined as substance which will react with an acid to form a salt and water. Thus if the base, Sodium Hydroxid, NaOH, is brought in contact with Hydrochloric Acid, HCl, the product is a salt, NaCl, and water, H₂O. The chemist expresses this change thus:



and this action is typical of any base with any acid.

The positive radicle of the base unites with the negative radicle of the acid to form a new compound, which is called a salt. The positive H radicle of the acid unites with the negative OH radicle of the base to form HOH, or as it is more commonly written, H₂O, water.

It will be noted that just as the positive H radicle is necessary in every acid, so the negative OH radicle is the essential constituent of all bases.

Bases are classed as **monoacid**, **diacid** and **triacid**, according to the number of hydroxid radicles which they contain. Since the hydroxid radicle has a valence of one, this classification can also be made on the basis of the valence of the positive radicle of the base. Thus:

Monoacid bases (contain one hydroxid radicle, positive radicle univalent).

NaOH — Sodium hydroxid.

KOH — Potassium hydroxid.

AgOH — Silver hydroxid.

Diacid Bases (contain two hydroxid radicles, positive radicle divalent).

Ca(OH)₂ — Calcium hydroxid.

Ba(OH)₂ — Barium hydroxid.

Mg(OH)₂ — Magnesium hydroxid.

Triacid bases (contain three hydroxid radicles, positive radicle trivalent).

Al(OH)₃ — Aluminum hydroxid.

Sb(OH)₃ — Antimony hydroxid.

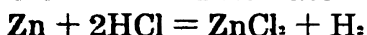
OXIDS. With the single exception of Fluorin, all elements which possess valence will unite with Oxygen, and when no third element is present these compounds are called **Oxids**. An oxid of any element may be formed by burning it in air, or Oxygen, some elements uniting readily and rapidly with Oxygen, others slowly and with some difficulty.

In general it may be stated that just as we have two kinds of elements, positive and negative, so do we have, corresponding to them, two kinds of oxids. Oxids of the metals (such as copper oxid, Magnesium Oxid, Calcium Oxid), on the addition of water, form bases. Hence they are known as **basic oxids** or **basic anhydrids**. Oxids of the negative elements (non-metals) unite with

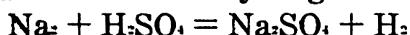
water to form acids and so are known as acid oxids or acid anhydrids.

SALTS. It may be stated that all compounds in inorganic chemistry which cannot be classed as Oxids, Acids, or Bases will fall into the group of compounds known as Salts. A salt, then, is a compound composed of a positive radicle, not Hydrogen, united to a negative radicle, not the oxid or hydroxid. (Note that the negative radicle may be either simple or compound.) It may be deduced then from the definition that the positive radicle of a salt will also be found in some base as the positive radicle, and the negative radicle of a salt will also be found in some acid as the negative radicle. Thus the typical salt, Sodium Chlorid, NaCl, has as its positive radicle Sodium, which is also found in the base NaOH, and as its negative radicle Chlorin, which is also the negative radicle of Hydrochloric Acid, HCl.

Usually when an acid is brought into contact with a metal a salt is formed by the metal ousting the Hydrogen and assuming its place as the positive radicle of the compound. The Hydrogen is set free. Thus Zinc and Hydrochloric Acid, in contact, react to form Zinc Chlorid and liberate Hydrogen.



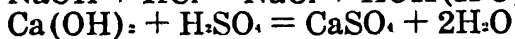
or Sodium and Sulphuric Acid react to form Sodium Sulphate (a salt) and also liberate Hydrogen.



These actions in general are typical of the action of any metal with any acid and represent one way of forming salts. The acid is said to be neutralized because all its acid characteristics—sourness, positive replaceable Hydrogen and its power to change blue vegetable dyes to red—have been lost.

These properties possessed by all acids are entirely absent in salts.

Acids may also be neutralized by being placed in contact with bases, in an action much like that of acids on metals, but slightly complicated by the presence of the hydroxid radicle. This Sodium Hydroxid and Hydrochloric Acid react to form Sodium Chlorid (a salt), and the Hydrogen of the acid unites with the negative hydroxid radicle to form Hydrogen Hydroxid, HOH, which we are more familiar with as H₂O, water. Similarly, any acid will react with any base to form a salt (composed of the positive radicle of the base united to the negative radicle of the acid) and water.



These two methods, action of an acid on a metal and action of an acid on a base are two of the most common ways, but by no means the only ways, of forming salts.

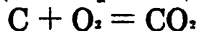
Salts, like acids, may be divided into two main classes, OXY and NON-OXY according to the presence or absence of Oxygen in their composition. The system for naming (chemically) oxy salts is closely related to that for naming oxy acids. Just as the

most common acid of a group, or family, of oxy acids takes the terminal "ic", so the most common salt of a family, having the same negative radicle as the "ic" acid, takes the terminal ending "ATE." Thus Na_2SO_4 having the same negative radicle as SulphurIC Acid, H_2SO_4 , has the chemical name Sodium SulphATE. The salt with a negative radicle identical with that of any "OUS" acid takes the terminal ending of its name "ITE." The salt related to the HYPO—OUS acid is named Sodium (or whatever the positive radicle may be) HYPO—ITE. This relationship will be readily seen in the following tabulation of acids and salts:

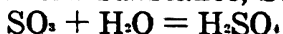
ACID		SALT	
Formula	Name	Formula	Name
HClO_3	Chloric Acid	NaClO_3	Sodium chlorATE
HClO_2	Chlorous Acid	NaClO_2	Sodium chlorITE
HClO	Hypochlorous Acid	NaClO	Sodium HYPOchlorITE

EQUATIONS

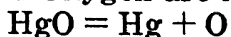
Chemical change is necessarily a change in composition. The process of the change is called reaction. Or, it may be stated that a reaction is a chemical process in which one or more substances are changed into one or more new substances. The form of chemical change known as COMBINATION, in which two or more substances (either elements or compounds) are united to form a new compound, is an example of a reaction. When coal burns the element Carbon unites with the element Oxygen to form a new substance (a compound) Carbon Dioxide.



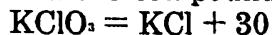
When Sulphur Trioxid, a compound, is added to water, another compound, a new substance, Sulphuric Acid is formed.



The opposite of COMBINATION is DECOMPOSITION, which is a reaction in which a compound is broken down into its constituent elements, or into simpler compounds. When Mercuric Oxid is heated the compound is broken up and the two elements Mercury and Oxygen are liberated.

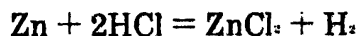


When Potassium Chlorate is heated the Oxygen is liberated as an element and the compound Potassium Chlorid remains.

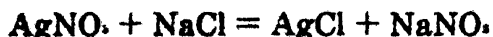


Often when two or more compounds are placed in contact with each other, particularly if they are in solution in water, an exchange of radicles takes place, forming new compounds; or if a metal is placed in contact with an acid, the metal displaces the Hydrogen from the acid, forming a salt. Such reactions are known as REARRANGEMENT. There is a rearrangement of radicles.

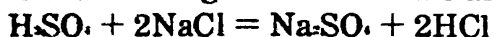
Zinc placed in Hydrochloric Acid unites with the chlorid radicle to form Zinc Chlorid and gaseous, elemental Hydrogen is liberated.



When Silver Nitrate solution is added to a solution of common table salt, Sodium Chlorid, a white, cloudy precipitate is formed immediately. This is a new compound, Silver Chlorid. Sodium Nitrate is formed at the same time, but remains invisible in the solution.



When Sulphuric Acid is added to a solution of common salt, Hydrochloric Acid and Sodium Sulphate are formed. By heating slightly the Hydrochloric Acid may be driven off as a gas and collected in a suitable container. This method of manufacturing Hydrochloric Acid is in general commercial use.



Note how the short one-line expressions of symbols and formulas convey, in each case, all the information that was written out in full above them. The equal signs (=) indicate that the materials on the left hand pass, or are changed, in the reaction to the materials on the right hand. These symbolic expressions are called equations. They show very briefly, but chemically completely, what takes place in the various chemical changes or reactions.

Reactions of REARRANGEMENT, such as the last three, are the most common. In these the positive radicle of the first compound leaves its original negative mate, and unites with the negative radicle of the second compound. In like manner the positive radicle of the second compound joins with the negative radicle of the first to form a new compound. Note that not only is each radicle originally on the left side, also present on the right side, but also every atom of every element found on the left side is also found on the right side. The total number of atoms of each originally present is also present in reaction products. This makes each expression a true equation, and is in accord with the axiom that matter cannot be destroyed.

To write an equation representing chemical change we must record first what substances were used, and second what substances were formed. The initial substances are placed on the left and on the right of the equal sign those which are produced. The equation is balanced by placing the proper coefficients before each formula.

It should not be necessary to add that a chemical equation gives the proportions of the materials used, but nothing more. The physical properties, whether the substances are dissolved in a liquid, are solids or are gases; are at a high or a low temperature; whether energy in the form of heat or electricity was involved; these have no place in the equation, though they may be necessary for a full description of the change. The equation is an essential part, but only a part of such a statement.

A CLASSIFICATION OF THE ELEMENTS BASED ON THE KINDS OF COMPOUNDS WHICH THEY FORM

GROUP ONE—

The Rare Air Gases

Argon, A
Helium, He
Neon, Ne
Krypton, Kr
Xenon, Xe

Form no compounds whatever, Zero
Valence.
Differ one from another only in atomic
weight.

Collectively make up 1% of Air.
Argon most abundant 0.9% of Air.

GROUP TWO—

The Acidulous Elements

Cl, F, Br, I
S
N, P, As, B
C, Si

Includes all the Negative Elements.
Their oxids are acid anhydrids.
They never form Bases.
They never form the positive radicles of
oxy-salts.

GROUP THREE—

The Base-Forming Elements

Na, K, Li, Ag
Cu, Hg
Ca, Ba, Sr, Ra, Mg
Bi

Includes all the strongly Positive Metals.
Their oxids are basic anhydrids.
They are never found in an acid mole-
cule.
They do form positive radicles of oxy-
salts.
They are never found in the negative
radicles of oxy-salts.

GROUP FOUR—

The Amphoteric Elements

Pb, Zn
Au
Cr, Mn, Fe, Al
Sn, Pt
Sb

Includes all the weakly positive Metals.
Their oxids are often both acid and basic
anhydrids.
They form weak bases and weak acids.
They are found in both positive and
negative radicles of oxy-salts.
Their positive and basic properties pre-
dominate.

GROUP FIVE—

Typical Elements

H, positive
O, negative

Fall in no other class.

QUESTIONS ON FRESHMAN WORK

1. Define: Science, Chemistry, Atom, Molecule, Atomic Weight, Molecular Weight, Inorganic Chemistry, Organic Chemistry.

2. Define and give an example of each: Matter, Element, Compound, Analysis, Synthesis, Valence, Symbol, Formula, Chemical Equation, Oxid, Metal, Acid, Base, Salt, Coefficient, Exponent, Malleable, Ductile, Basic Anhydrid, Acid Anhydrid, Monoacid Base, Diacid Base, Monobasic Acid, Dibasic Acid, Tribasic Acid, Simple Radicle, Compound Radicle, Physical Change, Chemical Change, Normal Salt, Acid Salt, Basic Salt, Double Salt, Electrolysis.

3. Name and give examples for each of the states of Aggregation of Matter.

4. Give the Law of Definite Proportions.

5. Does it apply to mixtures of elements?

6. What active element does not unite with Oxygen?

7. How are elements classified Physically?

8. How are elements classified Chemically?

9. Name the four principal classes of compounds and write a formula for each.

10. Is the valence of each element always the same?

11. In compounds, with what element are valences most likely to change?

12. Does the valence of a compound radicle ever change?

13. What products are always formed when an acid reacts with a base? Give an example.

14. What products are usually formed when an acid reacts with a metal? Give an example.

15. What products are usually formed when an acid reacts with a salt? Give an example.

16. What products are usually formed when two salts react? Give an example.

17. What acids yield or contain the following radicles: Nitrate, Sulphite, Hypophosphite?

18. What is the valence of each of the above radicles?

19. How is an acid recognized from its formula?

20. How is a base recognized from its formula?

21. How is an oxid recognized from its formula?

22. How is a salt recognized from its formula?

23. How many atoms in one molecule of Magnesium Sulphate, Calcium Phosphate, Nitrous Acid?

24. Give the three characteristics of acids.

25. What effect do Bases have on red vegetable dyes? On blue vegetable dyes?

26. Define Hydro Acid and give the formulas for three.

27. Define Oxy Acid and give the formulas for three.

28. Define Non-Oxy Acid and give the formulas for three.
29. Give the names, symbols, and valence of seven negative elements.
30. Give the names, symbols, and valence of ten positive metallic elements.
31. The positive, metallic element, Cesium, has the symbol Cs. The valence is one. What is the formula for Cesium Hydroxid? Cesium Chlorate? Cesium Phosphite?
32. The positive metallic element, Strontium, has the symbol Sr, valence is two. What is the formula for Strontium Hydroxid, Strontium Nitrate, Strontium Sulphite?
33. Which element is the standard of valence?
34. Which element is the standard of atomic weight?
35. Which is the lightest element?
36. Which element forms the positive radicle of acids?
37. Which element, with Oxygen, forms the negative radicle of bases?
38. Give the names and formulas for three Oxy Acids.
39. Give the names and formulas for three Non-Oxy Acids.
40. Give the names and formulas for three Hydro Acids.
41. Give the names and formulas for three Bases.
42. Give the names and formulas for three positive or metallic Oxids.
43. Give the names and formulas for three negative or non-metallic Oxids.
44. Give the names and formulas for three Non-Oxy Salts.
45. Give the names and formulas for three Oxy Salts.
46. Give the names and formulas for three Oxy Acids containing Nitrogen.
47. Give the physical characteristics of the metals.
48. State some of the differences between physical mixtures of elements and chemical compounds of elements.

BALANCE THE FOLLOWING EQUATIONS

1. Nitric Acid plus Potassium Hydroxid.
2. Sodium Chlorid plus Sulphuric Acid.
3. Sulphurous Acid plus Barium Hydroxid.
4. Hydrochloric Acid plus Magnesium Nitrate.
5. Silver Nitrate plus Aluminum Chlorid.
6. Zinc plus Hydrochloric Acid.
7. Zinc Oxid plus Hydrochloric Acid.
8. Zinc Hydroxid plus Hydrochloric Acid.
9. Zinc Nitrate plus Hydrochloric Acid.
10. Chloric Acid plus Sodium Hydroxid.
11. Chloric Acid plus Copper Hydroxid.

12. Chloric Acid plus Aluminum Hydroxid.
13. Iron Chlorid plus Potassium Nitrite.
14. Zinc Chlorid plus Potassium Cyanid.
15. Tin Chlorid plus Hydrogen Sulphid.
16. Tin Chlorid plus Hydrogen Sulphate.
17. Aluminum Hydroxid plus Sulphuric Acid.
18. Calcium Hydroxid plus Phosphoric Acid.
19. Write the equation for the action when Hydrogen burns.
20. Write the equation for the action when coal burns.

PROBLEMS

1. How much Sulphur in one ounce of Barium Sulphate?
2. How much Oxygen in one pound of Calcium Oxid?
3. Which contains the most Oxygen, a pound of Calcium Oxid or a pound of Calcium Hydroxid?
4. How much rust will be formed by the oxidation of one pound of iron?
5. How much Zinc Chlorid will be formed by the action of an excess of Hydrochloric Acid on one ounce of Zinc?

CLASSIFICATION OF POSITIVE ELEMENTS ACCORDING TO VALENCY

(Those in **Bold Type** appear in more than one column)

1	2	3	4	5
H	Ca	Sb	Pt	Sb
Na	Ba	Bi		Bi
	Sr			
K	Mg	Al		
	Co			
Li	Zn			
	Cd			
Cs	Fe	Fe		
	Ni			
Rb	Pb		Pb	
	Sn		Sn	
Ag	Mn	Mn		
Hg	Hg			
Cu	Cu			
Au		Au		

(This list is complete only insofar as those elements we will study.)

In the naming of a compound in which the positive element has two different valences, the OUS ending is employed to indi-

cate the lowest valency and the IC ending the highest. Example: MercurOUS Chlorid, mercury having a valency of one, and MercurIC Chlorid, mercury here having its highest valency, which is two. Chemical formulae would be HgCl and HgCl₂.

CLASSIFICATION OF NEGATIVE ELEMENTS ACCORDING TO VALENCY

1	2	3	4	5
F	S	N	C	N
Cl	O	P	Si	P
Br		As		As
I		B		

AMPHOTERIC ELEMENTS

Antimony	Tin	Iron	Lead	Manganese
Zinc	Gold	Aluminum	Chromium	Platinum

These elements form both weak acids and weak bases. They may therefore be found in either the positive or the negative radicle of oxy salts.

The Sophomore division of chemistry is given up to the systematic study of individual elements, according to the following outline:

Name of Element	Name of Element
SYMBOL	PREPARATION
VALENCY	PHYSICAL PROPERTIES
ATOMIC WEIGHT	CHEMICAL PROPERTIES
POSITIVE or NEGATIVE	COMPOUNDS
OCCURRENCE	USES

By OCCURRENCE we mean how the element exists—free, uncombined, or does it exist combined with some other element or elements.

By PREPARATION, how may it be obtained in the free state.

By PHYSICAL PROPERTIES, those properties that may be detected by physical means, such as color, state of aggregation, taste, odor, whether it is poisonous or not, and if it has any special properties, such as being very malleable, ductile, or brittle.

By CHEMICAL PROPERTIES, its behavior with other elements, as ACTIVITY, does it combine readily with other elements at ordinary temperature, does it form ACIDS or BASES?

By COMPOUNDS, does it form ACIDS, OXIDS, SALTS, or BASES?

By USES, the commercial application and the medicinal uses of an element or compounds that it forms.

CHARACTERISTICS OF THE HALOGEN GROUP

FLUORIN, CHLORIN, BROMIN, and IODIN have certain characteristics in common which distinguish them as a group. They are:

1. They occur combined only.
2. They are all negative.
3. They are all univalent.
4. They combine directly with Hydrogen to form acids, all of which are gases.
5. Any one will displace another, of higher atomic weight, from a compound that is soluble.
6. The color deepens with an increase in atomic weight.
7. Their activity lessens with an increase in atomic weight.
8. The higher the atomic weight the greater the stability of the compound with Oxygen.

CHARACTERISTICS OF THE ALKALI METALS

This group of elements comprise Sodium, Potassium, Lithium, Cesium and Rubidium. As a group they possess some very outstanding properties.

1. They occur in the combined state only.
2. They are univalent.
3. They are all positive elements.
4. They decompose water with the liberation of Hydrogen and the formation of hydroxids.
5. Chemically they are the most active of all positive elements.
6. They are of a waxy consistency, but when freshly cut present the usual metallic luster.
7. They are unstable in the air and therefore need to be kept in oil or in a hermetically sealed container.
8. They form the strongest hydroxids known.

CHARACTERISTICS OF THE ALKALI EARTH METALS

The same as the Alkali Metals except that the valency is two instead of one.

They come next to the alkali metals in activity.

They form hydroxides that are somewhat weaker than the hydroxides of the alkali metals.

CLASSIFICATION OF OXIDS

1. Acid anhydrids.
2. Basic anhydrids.
3. Neither.

Those oxids which are acid anhydrids are always oxids of negative elements. Following is a list of the oxid acid anhydrids and opposite the acid which they form:

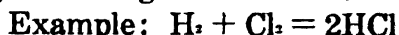
Fluorin	None		
Chlorin	Cl_2O , Cl_2O_7		HClO , HClO_4
Bromin	None isolated		
Iodin	I_2O_5		HIO_3
Sulphur	SO_2 , SO_3		H_2SO_3 , H_2SO_4
Nitrogen	N_2O , N_2O_3 , N_2O_5		HNO , HNO_2 , HNO_3
Phosphorus	P_2O_3 , P_2O_5		H_3PO_3 , H_3PO_4
Arsenic	As_2O_3 , As_2O_5		H_3AsO_3 , H_3AsO_4
Antimony	Sb_2O_3 , Sb_2O_5		H_3SbO_3 , H_3SbO_4
Carbon	CO		H_2CO
Silicon	None		
Boron	B_2O_3		H_3BO_3

Those oxids which are base forming are always oxids of positive elements. Following is a list of those oxids which are basic anhydrids, and opposite the hydroxid formed.

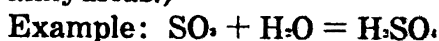
Sodium Oxid	Na_2O		NaOH
Potassium Oxid	K_2O		KOH
Lithium Oxid	Li_2O		LiOH
Cesium Oxid	Cs_2O		CsOH
Rubidium Oxid	Rb_2O		RbOH
Calcium Oxid	CaO		Ca(OH)_2
Barium Oxid	BaO		Ba(OH)_2
Strontium Oxid	SrO		Sr(OH)_2

METHODS FOR THE PREPARATION OF ACIDS

1. By the direct union of Hydrogen and a negative element. (All negative elements will not unite directly with Hydrogen to form acids; the Halogen elements and Sulphur are the only ones.)



2. By the addition of water to an acid anhydrid. (See under list of acid anhydrids.)



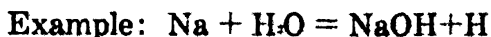
3. By the reaction between a salt and another acid.



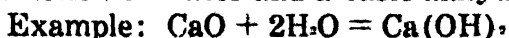
All acids may be made by at least one of these three methods.

METHODS FOR THE PREPARATION OF HYDROXIDS

1. By the action of water upon the alkali metals and earths at ordinary temperature, and some other metals at a higher temperature.



2. By the action of water and a basic anhydrid.



3. By the reaction between a salt and another hydroxid.



All hydroxids may be made by at least one of these three methods.

METHODS FOR THE PREPARATION OF SALTS

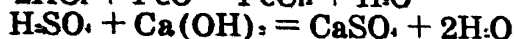
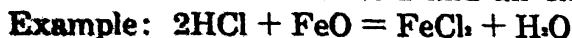
1. By the direct union of two elements.



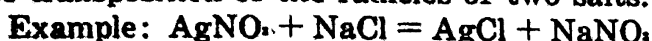
2. By the action of an acid upon a metal.



3. By the reaction between an acid and an oxid or hydroxid.



4. By the transposition of the radicles of two salts.



SYNONYMS

This is a classification of the common names applied to chemical compounds, arranged according to the nature of the compound.

Chemical Name	Chemical Formula	Synonym
Acids—		
Hydrochloric Acid	HCl	Muriatic Acid
Sulphuric Acid	H_2SO_4	Oil of Vitriol
Hydrocyanic	HCN	Prussic Acid
Chlorids—		
Sodium Chlorid	NaCl	Table Salt
Ammonium Chlorid	NH_4Cl	Sal Ammoniac
Mercurous Chlorid	HgCl_2	Calomel
Mercuric Chlorid	HgCl_2	Corrosive Sublimate
Carbonates—		
Sodium Carbonate	Na_2CO_3	Sal Soda
Sodium Bicarbonate	NaHCO_3	Baking Soda, Saleratus
Potassium Carbonate	K_2CO_3	Salts of Tartar
Calcium Carbonate	CaCO_3	Chalk, Limestone, Marble
Lead Basic Carbonate	$\text{Pb}(\text{OH})_2 \cdot \text{PbCO}_3$	White Lead
Lead Carbonate	PbCO_3	Flake White
Ammonium Carbonate	$(\text{NH}_4)_2\text{CO}_3$	Bakers' Ammonia
Hydroxids—		
Ammonium Hydroxid	NH_4OH	Ammonia, or Ammonia Water
Sodium Hydroxid	NaOH	Lye, Caustic Soda
Magnesium Hydroxid	$\text{Mg}(\text{OH})_2$	Milk of Magnesia
Bismuth Hydroxid	$\text{Bi}(\text{OH})_3$	Milk of Bismuth
Calcium Hydroxid (solution of)	$\text{Ca}(\text{OH})_2$	Lime Water, Slaked Lime
Nitrates—		
Sodium Nitrate	NaNO_3	Chili Saltpetre
Potassium Nitrate	KNO_3	Saltpetre, or Bengal Saltpetre
Silver Nitrate	AgNO_3	Lunar Caustic

Chemical Name	Chemical Formula	Synonym
Oxids—		
Nitrous Oxid	N_2O	Laughing Gas
Calcium Oxid	CaO	Quicklime
Lead Oxid	PbO	Litharge
Arsenious Oxid	As_2O_3	White Arsenic
Sulphids—		
Lead Sulphid	PbS	Galena
Mercuric Sulphid	HgS	Cinnabar
Ferrous Sulphid	FeS	Pyrites of Iron
Arsenic Trisulphid	As_2S_3	Kings' Yellow
Sulphates—		
Zinc Sulphate	$ZnSO_4$	White Vitriol
Ferrous Sulphate	$FeSO_4$	Green Vitriol
Copper Sulphate	$CuSO_4$	Blue Vitriol
Magnesium Sulphate	$MgSO_4$	Epsom Salt
Sodium Sulphate	Na_2SO_4	Glauber Salt
Miscellaneous—		
Lead Acetate	$Pb(C_2H_3O_2)_2$	Sugar of Lead
Copper Aceto- Arsenite	$Cu_3(AsO_3)_2$ $Cu(C_2H_3O_2)_2$	Paris Green
Copper Acid Arsenite	$CuHAsO_3$	Scheeles' Green
Potassium Acid Tartrate	$KH(C_4H_4O_6)$	Cream of Tartar
Sodium Tetraborate	$Na_2B_4O_7$	Borax
Sodium Silicate	Na_2SiO_3	Water Glass

REVIEW QUESTIONS ON THE NEGATIVE ELEMENTS

1. Is Hydrogen a positive or negative element? (P. 54)
2. In what natural existing compound is it found most abundantly? (P. 54)
3. How may it be obtained in the free state? (P. 54)
4. Name five compounds containing Hydrogen. (See your lecture notes.)
5. Write an equation showing the liberation of Hydrogen from an acid. (P. 55)
6. What percentage of the earth's crust is said to be Oxygen? (P. 56)
7. Give the physical properties of Oxygen. (P. 56)
8. Define an oxid. Give an example. (P. 12-57)
9. What name is applied to those oxids which, upon the addition of water, form acids? Give an example. (P. 57)
10. How may free Oxygen be obtained? (P. 56)
11. Is air a compound or a mixture? How much Oxygen does it contain? (P. 68)
12. What form of Oxygen is ozone? Give its formula. (P. 57)
13. What is the function of Oxygen in the human body? (P. 57)
14. What is the Oxygen-carrying compound of the blood called? (P. 191-213)
15. Name the Halogen elements and give the state of aggregation of each. (P. 58-61-62-64)
16. Give three characteristics of this group. (See supplement, Halogen Group.)
17. Name a natural existing compound of each. (P. 58-61-62-64)
18. Give the atomic weight of each. (P. 40)
19. Name the hydro-acid of each. (P. 59-62-63-65)
20. What is a common name applied to Hydrochloric acid? (See synonyms in supplement.)
21. Write an equation showing the formation of an acid of each halogen from some salt. (P. 59-62-63-65)
22. What is AQUA REGIA? (P. 60)
23. What acid cannot be kept in a glass container? (P. 62)
24. How does Nitrogen occur? (P. 66)
25. What are its most common valencies? What is its atomic weight? (P. 66)
26. Outline one method for obtaining free Nitrogen. (P. 66)
27. State its chemical properties. (P. 67-72)
28. In what compound is it found in the human body and vegetable material? (See Proteins, P. 191.)
29. What natural existing salt is rich in Nitrogen? (P. 66)

30. What is the percentage of Nitrogen in the air? (P. 67-68)
31. Give the formula for gaseous ammonia. (P. 69)
32. Write an equation showing what is formed when this is added to water. (P. 69)
33. What is the ammonium radicle? (P. 110)
34. What is the commercial source of ammonia? (P. 70)
35. What are some of the uses of Nitrogen? (Lecture outlines.)
36. What is the name and formula for the most common acid of Nitrogen? (P. 72)
37. What is the name applied to the salts from this acid? (P. 73)
38. What is the valency of the nitrate radical? (P. 73)
39. How many oxides of Nitrogen? Give their formulas. (P. 71)
40. Which of these oxides are acid anhydrides? (P. 71)
41. What is the atomic weight of Sulphur? (P. 75)
42. How does it occur? (P. 75)
43. Name some of the natural existing compounds of Sulphur. (P. 75)
44. What is formed when Sulphur burns? Give its formula. (P. 79)
45. What acid is formed when SO_2 is added to water? (P. 82)
46. What is the anhydride of Sulphuric Acid? (P. 80)
47. Write an equation showing how H_2S may be produced. (P. 77)
48. Give an example of a dibasic acid. (P. 77-80-89-119)
49. If "A" has a valency of three, what is the formula for its sulphate?
50. Give the symbol and valency of Phosphorus. (P. 84)
51. How does it occur? (P. 84)
52. What is the name of the Phosphorus salt found in bone? (P. 85)
53. What is the common source of Phosphorus? (P. 85)
54. Give the chemical properties of Phosphorus. (See lecture outlines.)
55. What are the allotropic forms of Phosphorus? (P. 86)
56. What is the chemical difference between Red and Yellow Phosphorus? (P. 86)
57. What are the physical differences? (P. 86)
58. How would Phosphoric Acid be made from Calcium Phosphate? (P. 90)
59. Give the formula for the oxides of Phosphorus. (P. 88)
60. Is Phosphorous Acid a dibasic or tribasic acid? (P. 89)
61. Write the formula for a phosphite salt. (The phosphite radicle is (PHO_2) from $\text{H}_3(\text{PHO}_2)$ Phosphorus Acid.)

62. Write the formula for a phosphate salt. (P. 90)
63. What natural compound contains Arsenic in the greatest quantity? (P. 90)
64. What is the chemical name for white Arsenic, or flowers of Arsenic? (P. 91)
65. Write the formula for the two oxids of Arsenic. (P. 91-92)
66. What is the Hydrogen compound of Arsenic called? (P. 91)
67. What is the name of a common test used to identify Arsenic? (P. 181. See under Marsh's test.)
68. Write the formula for Arsenious and Arsenic Acid. (P. 92)
69. What is the name given the salts formed from each acid? (P. 92)
70. Name two common compounds of Arsenic. (P. 91-92-93)
71. What is the symbol for Antimony? Its valency? (P. 94)
72. What is meant by an amphoteric element? (See definitions in supplement.)
73. Is Antimony an amphoteric element? (See list amphoteric elements in supplement.)
74. What is the chemical name for this salt, K_2SbO_4 ? (P. 96)
75. Is Bismuth a positive or negative element? Valency? (P. 96)
76. What are some of the uses of Bismuth? (P. 97)
77. Give the formula for Bismuth subcarbonate, Bismuth basic Carbonate. (See lecture notes.)
78. What is organic chemistry? (P. 190)
79. What is the usual valency of Carbon? (P. 113)
80. What is its valency when combined with Oxygen? (P. 116-118)
81. Give the formula for the two oxids of Carbon. (P. 116-118)
82. Is Carbon a reducing or oxidizing agent? Give an example by equation. (See bottom P. 90. See under Zinc P. 134.)
83. What is formed when Carbon Monoxid burns? (P. 117)
84. Will Carbon Dioxid burn? (P. 118)
85. Name a natural solid compound containing Carbon. (P. 113)
86. Name a natural liquid compound containing Carbon. (See lecture notes.)
87. Give the formula for Carbon Disulphid. (P. 119)
88. Name three allotropic forms of Carbon. (P. 114)
89. What is the acid produced from Carbon? (P. 119)
90. What is the name of the salt that Carbonic Acid produces? (P. 119)
91. What is the symbol and valency of Boron? (P. 121)
92. What is the most abundant natural compound of Boron? (P. 121)

93. What are the chemical constituents of borax? (P. 110)
94. What is the formula for Boric Acid? (P. 122)
95. Write the formula for Calcium and Sodium Borates. (See formula for acid, P. 122.)
96. Write the formula for Calcium Acid Borate; Sodium Diacid Borate. (See formula for acid, P. 122.)
97. Why is borax called a tetraborate? (See formula, P. 110.)
98. Give the symbol and valency of Silicon. (P. 123)
99. Is Silicon a positive or negative element? (P. 123)
100. Name two of its most abundant compounds. (P. 123)
101. What percentage of the earth's crust is said to be Silicon? (P. 123)
102. In what structures of the human body is it found? (P. 125-242)
103. What is the chemical name for carborundum? (P. 126)
104. What are the most common salts of Silicon? (P. 123)
105. Give the silicate radicle and its valency. (P. 125)
106. State two commercial uses of Silicon. (P. 124-125)
107. Chemically speaking, what is feldspar? (P. 130)

ALKALI METALS AND ALKALI EARTHS

1. What elements constitute the alkali metal group? (P. 39)
2. What elements constitute the alkaline earth group? (P. 39)
3. Are the alkali metals positive or negative, and what is their valency? (P. 39)
4. State three characteristics of the group. (See supplement.)
5. What kind of compounds do the alkali metals or their oxides form when added to water? (See supplement under Alkali Metals.)
6. What are the common physical properties of the alkali metals? (See supplement.)
7. In what way do the alkali metals and earths differ? (See supplement.)

POTASSIUM

1. What is the Latin name and symbol for this element? (P. 98)
2. What are the most abundant natural existing compounds of Potassium? (See under Occurrence of Halogen elements.)
3. What are the physical properties of Potassium? (P. 98)
4. Give a common name for Potassium Nitrate. (P. 102)
5. What is the chemical formula for caustic potash? (P. 99)
6. Are compounds of Potassium found in the human body? (P. 98)
7. What Potassium salts are used in the manufacture of explosives? (P. 101-102)

8. What is the color of Potassium through the spectroscope? (P. 183)

9. What is the commercial source of Potassium? (See Lecture Notes.)

SODIUM

1. What is the color of the Sodium flame? (P. 183)

2. Give the Latin name for Sodium. Give its atomic weight. (P. 105)

3. What is formed when elemental sodium or its oxid is added to water? (P. 105-106)

4. Give the CHEMICAL name and FORMULA for the following: Baking Soda, Sal Soda, Chili Saltpetre, Glauber Salts, Silex, Water Glass, Borax, Lye. (See Synonyms in supplement.)

5. What is the most poisonous compound of Sodium? (See Lecture Notes.)

LITHIUM

1. What is the symbol and atomic weight for Lithium?

2. Which is the lightest metal known? (See Lecture Notes.)

3. What is Lithia Water? (P. 112)

CESIUM AND RUBIDIUM

1. Give their symbols and valences.

2. Does Cesium have a different valency toward the halogen elements? (P. 113)

3. What is the strongest hydroxid known? (P. 113)

AMMONIUM

1. What is the ammonium radicle? (P. 110)

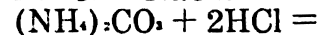
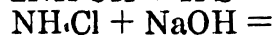
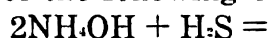
2. Is it a positive or negative radicle, and what is its valency? (P. 110)

3. How is it formed? (Reverse Equation on P. 69)

4. What is the chemical name and formula for Sal Ammoniac? (P. 70)

5. How may Ammonium Salts be detected easily? (P. 112)

6. Balance the following equations:



(See subject of equations and methods for the preparation of acids, salts, and hydroxides in supplement.)

CALCIUM

1. Where and how does Calcium occur? (P. 127)

2. What is its symbol and valency? (P. 126)

3. Give a common name for CaO. (P. 127)

4. State some of the commercial uses of CaO . (P. 127-8)
5. Which is the most abundant existing compound of Calcium? (P. 128)
6. Give some of the common names for various forms of Calcium Carbonate? (P. 128)
7. How is plaster of Paris made? (P. 128)
8. What salt of Calcium is found in bone? Give its formula. (P. 128)
9. What salt of Calcium is used as a fertilizer? (P. 128)
10. What is Feldspar? (P. 130)
11. What is glass? (P. 125-130)

BARIUM

1. Give its symbol.
2. What compound of Barium is used in X-Ray diagnosis? (See Lecture Notes.)

MAGNESIUM

1. Give the symbol and valency. (P. 133)
2. What is formed when Magnesium burns? (P. 133)
3. What form of Magnesium is used in photographic flash powders? (P. 133)
4. What compound of Magnesia is called "milk of Magnesia"? (See Lecture Notes.)
5. Write the formula for Epsom Salts. (P. 133)
6. Write the formula for Magnesia Carbonate. (P. 134)
7. How much MgSO_4 will one ounce of Magnesium make? (See Lecture Notes.)

ZINC

1. In what form does it occur naturally? (P. 134)
2. With what other element is it usually associated? (P. 134)
3. What is galvanized iron? (P. 135)
4. Write an equation showing the production of ZnO . (P. 134-135)
5. What is one commercial use of Zinc Oxide? (P. 135)
6. Write the formula for White Vitriol, or Zinc Sulphate. (P. 136)

MERCURY

1. What is the symbol, valency and atomic weight of Mercury? (P. 136)
2. What is another name for Mercury? (P. 136)
3. What is the formula for its most common natural form? (P. 136)
4. Give another name for this ore. (P. 136)
5. Define an amalgam. (P. 137)
6. State the physical properties of Mercury. (P. 137)

7. What is the valency of Mercury in all mercurous salts? (See Classification of Elements According to Valency.)

8. What is the valency of Mercury in all mercuric salts? (See same as above.)

9. What is the formula for calomel, corrosive sublimate? (P. 138)

10. Why is it necessary to protect all Mercury salts from the light? (P. 138)

11. Name a salt of Mercury that is different for each valency. (P. 139)

12. What does the terminal ending "IC" on the positive part of a compound indicate? (See notes under Classification of Positive Elements, supplement.)

COPPER

1. What name is applied to Copper salts in which the valency of Copper is one? (P. 141)

2. How does Copper occur? (P. 141)

3. Is anything peculiar about the physical properties of Copper?

4. What is the chemical name for Blue Vitriol? (P. 144)

5. What kind of a compound is verdigris? (See Synonyms in supplement.)

6. Is Brass an element, a compound, or an alloy? (P. 143)

SILVER

1. From what Latin word is the symbol for Silver derived? (P. 145)

2. What is its valency? (P. 145)

3. What silver salts are used in making photographic emulsions? (P. 148)

4. Write the formula for Silver Oxid, Chlorid and Phosphate. (P. 147-148)

5. What element is the best known conductor of electricity? (P. 147)

6. In the form of what compound is it found? (P. 145)

GOLD

1. Does it occur mostly free or combined? (P. 150)

2. Is Gold soluble in any one acid? (P. 151)

3. What combination of acids is it freely soluble in? (P. 151)

4. Name another solvent for Gold. (P. 151)

5. What metal is the most malleable and ductile of all? (P. 151)

6. Write the formula for aurous and auric oxids. (P. 151-152)

LEAD

1. What compound of Lead is known as Galena? (P. 152)
2. Which valency forms the greatest number of compounds used? (P. 152)
3. What is Litharge? Give its formula. (P. 154)
4. What is Flake White? (See list of synonyms in supplement.)
5. What kind of a compound is White Lead? (P. 155)
6. What is Sugar of Lead? (P. 156, and synonyms in supplement.)
7. Name some of the alloys of lead. (P. 153-157)
8. Is Lead an acid or base-forming element? (See amphoteric elements in supplement.)

TIN

1. Name two alloys containing Tin. (P. 153-157)
2. What is the CHEMICAL name for the following: SnO , SnO_2 ? (P. 158)
3. What is the valency of Tin? (P. 156)

ALUMINUM

1. What is the percentage composition of Aluminum in the earth's crust? (P. 159)
2. What are its most abundant natural existing compounds? (P. 159-160-163)
3. Name a common compound of Aluminum? (P. 162)

CHROMIUM

1. Why was this element so named? (See lecture notes.)
2. What are some of the uses of Chromium? (P. 164)
3. If H_2CrO_4 is the formula for Chromic Acid, what is the formula for Potassium Chromate? Lead Chromate? (P. 165-166)

IRON

1. What is the Latin word from which the symbol is obtained? (P. 168)
2. What is the valency? (P. 168)
3. What are the most important ores? (P. 168)
4. How is pure Iron obtained? (P. 169)
5. What can you say as to the physical properties? (P. 169)
6. What is a common name for FeS_2 , $\text{Fe}(\text{SO}_4)_2$, Fe_2O_3 ? (P. 172-173)
7. Name four amphoteric elements. (See list of elements in supplement.)
8. Balance the following equation and give the chemical name for the products formed: $\text{FeCl}_3 + 3\text{NH}_4\text{OH} =$

PLATINUM

1. Give its symbol and valency. (P. 176)
2. How does it occur? (P. 176)
3. What dissolves this element? (P. 176)
4. What is a catalytic agent? (See lecture notes.)

REVIEW QUESTIONS ON ORGANIC CHEMISTRY

1. Define Organic Chemistry. (P. 190)
2. Define carbohydrate and give an example. (P. 190-194)
3. Define monosaccharide, disaccharide, trisaccharide. (P. 190)
4. Give the chemical constituents of proteins. (P. 191)
5. What is hemoglobin chemically, and what is its function? (P. 191)
6. Name and give the formula for a very common monosaccharide. (P. 195)
7. What kind of a saccharide is SACCHAROSE? Give its common name. (P. 197)
Cane sugar.
8. What kind of saccharide is starch?
9. What are the three most common fatty acids in edible fats? (P. 201)
10. In what combination do fatty acids occur in fats and oils? (P. 203)
11. What is glycerine (glycerol) and from what is it obtained? (P. 203)
12. What is the principal source of proteins? (P. 205)
13. Are albumins proteins? (P. 206)
14. What distinguishes albumins from other proteins? (P. 191-209)
15. What are the two divisions of hydrocarbon compounds called? (P. 215)
16. Give the formula for the first member of the OPEN chain series. (P. 215)
17. Give the formula for the first member of the CLOSED chain series. (See Lecture Notes.)
18. Define an alcohol. (P. 219)
19. What is an ester? (P. 192-222)
20. What group or radicle characterizes an organic acid? (P. 225)
21. Is Carbolic Acid really an acid? What is it? (P. 230)
22. Give the chemical name for Carbolic Acid. (P. 230)

REVIEW QUESTIONS ON PHYSIOLOGICAL CHEMISTRY

1. Define Physiological Chemistry. (P. 239)
2. What is the percentage of water in the human body? (P. 241)

3. Name the elemental constituents of the body. (P. 241)
4. In what fluids of the body are alkaline carbonates found? (P. 243)
5. What structure of the body contains the least amount of water? (P. 245)
6. How much water in muscle, bone and blood? (P. 245)
7. What is the essential difference between ferments and enzymes? (P. 252)
8. What is the function of amylolytic enzymes? (P. 253)
9. Name two and tell where found. (P. 253-278 to 284)
10. Name the invertases, tell their action and where found. (P. 254)
11. What is a lypolytic enzyme? (P. 254)
12. Where do they occur in the body? (P. 255)
13. What is a proteolytic enzyme? (P. 255)
14. What are their end products? (P. 255)
15. Name the proteolytic enzymes; Where are each found? (P. 255)
16. What glands secrete saliva? (P. 270)
17. What are the two enzymes of saliva? (P. 270)
18. What is the reaction of saliva? (P. 270)
19. Name the enzymes secreted in the stomach. (P. 272)
20. Name the intestinal enzymes, and state the function of each. (P. 273-277)
21. Name all of the enzymes that would act upon fats, proteins and carbohydrates in the small intestines. (P. 278-284)
22. Name the constituents of blood. (P. 291)
23. What is the liquid portion of blood called? (P. 291)
24. Of what does hemoglobin consist? (P. 292)
25. What is methemoglobin? (P. 293)
26. What is the average number of erythrocytes to one cubic millimeter of blood? (P. 294)
27. How many leucocytes? (P. 294)
28. What are blood plates? (P. 296)
29. Explain the coagulation of blood. (P. 296)
30. Name the proteins found in blood. (P. 297)
31. What is lymph and where found? (P. 298)
32. Give the chemical constituents of lymph. (P. 298)
33. What is its chemical reaction? (P. 298)
34. Give the chemical constituents of sweat. (P. 302)
35. What is the nature of the secretion of the sebaceous glands? (P. 303)

URINALYSIS

1. What is urine? (P. 306)
2. What is the chief constituent of urine? How much? (P. 306)
3. What percentage of solids are found in urine? (P. 306)
4. What are the primary considerations in making a urinalysis? (P. 321)
5. What factors might normally cause an increase in the volume of urine? (P. 311) *reg. diet, water, nervousness, and at. tension*
6. What factors might normally cause a decrease in the volume? (P. 311) *ex. diet, ex. temp., ex. heat, and liquids.*
7. What factors might abnormally increase the volume? (P. 311) *D.M., diabetes, uremia, nephritis, D.D. light, etc.*
8. What factors might abnormally decrease the volume? (P. 311) *ex. diet, ex. heat, etc., fever, dehydration*
9. What factors normally increase the color of urine? (P. 313) *ex. diet, ex. temp., ex. heat, etc.*
10. What factors normally decrease the color? (P. 313) *ex. diet, ex. temp., ex. heat, etc.*
11. Name two incoordinations that would decrease the color of urine. (P. 313) *D.M., diabetes, uremia, nephritis, etc.*
12. Name two incoordinations that would increase the color of urine. (P. 313) *ex. diet, ex. temp., ex. heat, etc.*
13. Name the coloring pigments of urine. (P. 306)
14. What factors normally increase the specific gravity of urine? (P. 312) *ex. diet, ex. temp., ex. heat, etc.*
15. What factors would normally decrease the specific gravity? (P. 312) *water, starvation, etc.*
16. Name some incoordinations that would increase the specific gravity of urine. (P. 312) *D.M., diabetes, uremia, nephritis, etc.*
17. Name some incoordinations that would decrease the specific gravity of urine. (P. 312) *D.M., diabetes, uremia, nephritis, etc.*
18. Name a food that increases the odor of urine. (P. 314)
19. Name some incoordinations that change the odor of urine. (P. 314) *D.M., diabetes, uremia, nephritis, etc.*
20. What classification of foods normally increase the urea contents of urine? (P. 315) *Protein is only one.*
21. What other factor might also increase the urea content of urine? (P. 315)
22. Name some conditions that would normally decrease the urea content. (P. 315)
23. Name some incoordinations that would abnormally increase the urea. (P. 315)
24. Name some incoordinations that abnormally decrease the urea content. (P. 315)
25. Give the urinary findings in a case of fever. (P. 317)
26. Give the urinary findings in diabetes mellitus. (P. 317)

27. Give the urinary findings in a case of acute nephritis. (P. 311 to 317) *low vol. in h.c. - uera, high sp. gravity, some casts*
28. Give the urinary findings in chronic nephritis. (P. 311-17)
29. Is glycosuria pathognomonic of diabetes? (See Lecture Notes.) *yes*
30. What form of sugar is found in the urine abnormally? (See Lecture Notes.) *sucrose*
31. What ingredient in urine would indicate a serious condition if found in diabetic urine? (See Lecture Notes.)
32. Name two tests used for the identification of sugar in urine. (P. 321-24) *Barfoed's Test, Benedict's Test*
33. What test is both qualitative and quantitative? (P. 321) *mehta*
34. How high may the sugar content of urine run in diabetes before fatal results might ensue? (See Lecture Notes.)
35. What is diabetic sugar? (See Lecture Notes.)
36. What abnormal constituent would an early morning sample be most apt to reveal? (See Lecture Notes.) *pus or casts*
37. If albumin is suspected, when would be the best time for collecting a sample? (See Lecture Notes.) *2 or 3 hrs. after meals*
38. What condition of kidneys does the persistent presence of albumin indicate? (See Lecture Notes.) *✓ Angioid degeneration*
39. Describe the Heller's Ring Test. (P. 325)
40. Name a quantitative test for albumin. (P. 327)
41. Define hematuria. (See Lecture Notes.)
42. What would be the color of urine containing blood? (P. 306)
43. What conditions would blood in the urine indicate? (See Lecture Notes.) *h.c. or h.p. - renal, bladder, ureters, etc.*
44. Name an incoordination of the kidney in which hematuria might occur. (See Lecture Notes.)
45. Outline a chemical test for blood. (P. 327)
46. In what form is nitrogen found in the urine? (P. 308)
47. Give some of the characteristics of urine in uremia. (See Symptomatology.) *high sp. gr. little gross mud at bottom, cloudy, etc.*
48. What is the name of one of the chief solid constituents of urine? (P. 306) *urea*
49. What is urea? (P. 263)
50. Why is the amount of urea voided considered important? (P. 265)
51. How would the amount of urea be affected if the liver or kidney were not functioning properly? (P. 315)
52. In what other excretion is urea also found in small quantities? (P. 302 and 263) *perspiration*
53. Give some of the physical properties of urea. (P. 263)
54. What percentage of nitrogen waste is represented by urea? (P. 263)

55. What effect has urea upon the specific gravity of urine? (P. 268) *increases it.*
56. Outline a test for bile. (P. 331) *from a distinct color*
57. What is the importance of the presence of indican in the urine? (See Lecture Notes.) *has absorption of intestinal bacteria*
58. What is a test for indican? (P. 337) *Obeney's Reagent.*
59. Define Pyuria. *pus in urine.*
60. What is Mucin, and how detected in urine? (See Lecture Notes.) *chill & mucus - a glycoprotein, added to urine with*
61. How many grams of solid material is daily excreted through the kidneys? (P. 340) *Sp. for 2.6 gms. per 100 cc. H₂O*
62. Calculate the total solids in a specimen registering a specific gravity of 1.036. (P. 340)
63. What is meant by the term "casts in the urine"? (P. 347-348) *the mucus - mucus formation of urine tubule.*
64. What conditions do hyaline casts usually indicate? (P. 340) *infection, U.T.*
65. What is the significance of waxy casts? (P. 340) *renal congestion*
66. Where are waxy casts found? (P. 348) *in urine.*
67. Granular casts are usually associated with what other casts? (P. 348) *hyaline.*
68. In a sample of urine presenting a reddish-brown color what drugs would you suspect had been taken? (P. 307) *arsenic, cocaine, etc.*
69. What drug or chemical produces a deep blue or green colored urine? (P. 307) *indigo or methylene blue*

QUESTIONS ON TOXICOLOGY

1. Give the Chiropractic definition for a poison. (See Philosophy.)
2. Give another definition for a poison. (P. 349)
3. What is toxicology? (P. 349)
4. What is an emetic? (P. 350)
5. What is meant by the remote effects of poison? (P. 352)
6. Which class of poisons cause a destruction of tissue? (P. 349)
7. Name a poison producing a local effect. (P. 357)
8. Distinguish between the pathology of an irritant poison and a corrosive poison. (P. 349-369)
9. How are antidotes classified? (P. 356)
10. What conditions favor the activity of a poison? (P. 354)
11. What conditions do not favor the activity of a poison? (P. 354)
12. Name an inorganic acid poison. (P. 357)
13. Name an organic acid poison. (P. 361)
14. What is oil of vitriol? Give its formula. (P. 357-380)

15. What class of poisons effect primarily the nervous system? (P. 349)

16. By what means would you expect to recognize a case of phenol poisoning? (P. 363)

17. What is the common name for phenol? (P. 364)

18. Describe a case of phenol poisoning and tell what you would do for relief. (P. 363-364)

19. Name a chemical antidote for nitric acid poisoning. (P. 359)

20. By what physical signs would you be able to distinguish between nitric and sulphuric acid poisoning? (P. 357-358)

21. What is the most corrosive vegetable acid poison? (P. 361)

22. For what drug is oxalic acid often mistaken? (P. 361)

23. What form of poisoning does lysol resemble? (P. 365)

24. Name the most common alkali poisons? (P. 365)

25. What symptoms would you expect to find in a case of caustic alkali poisoning? (P. 366)

26. What antidotes are advisable in alkali and carbonate poisoning? (P. 366)

27. Besides non-toxic acids, what other agents are ideal chemical antidotes in alkali poisoning? What is the product formed? (P. 366-367)

28. Give the chemical name and antidote for the following: bakers' ammonia, sal soda, salts of tartar, lye. (P. 367)

29. If death does not result immediately from acid or alkali poisoning what might be the sequel? (P. 358-366)

30. How do irritant poisons differ in their actions from corrosive poisons? (P. 369) *burning sens. in st. later.*

31. What is a simple irritant poison; a specific irritant? (P. 369) *As. H₂O₂. Arsenic*

32. What are the general symptoms produced by irritant poisons? (P. 369)

33. Give another name for silver nitrate. (P. 371)

34. What is an escharotic? Name one. (P. 372)

35. What is the effect upon the external skin when lunar caustic is applied? (P. 372) *sloughy white stain.*

36. What is the best antidote in acute silver nitrate poisoning? (P. 372) *Salt*

37. Give two other names for Iron Sulphate. (P. 372)

38. Give two common vegetable irritants that are used as cathartics or purgatives. (P. 373) *Aloe, Croton*

39. Upon what properties of Aloe or Colocynth do their physiological action depend? (P. 373) *irritation of muc. memb.*

40. Give the physiological action of Iodin and the Iodides upon the body. (P. 375) *mostly burning, irritates, emphysema.*

41. What is chronic Iodin poisoning called? (See Lecture Notes.) *Iodism*

*4. H₂SO₄
2. H₂O₂
4. KOH
NaOH
3. K₂CO₃*

K₂Cr₂O₇ & H₂SO₄ food

So. Iodid. Offen

42. What is Bromism? (See Lecture Notes.) ✓
43. What functions of the body are interfered with in the use of bromids? (See Lecture Notes.)
44. What are the usual sources of phosphorus poisoning? (See Lecture Notes.)
45. By what means would you be able to recognize acute phosphorus poisoning? (P. 376) *odor & vomit*
46. Give some of the symptoms of chronic phosphorus poisoning. (P. 377) *brittle teeth decay teeth, gas esophagus - caries*
47. Name three common sources for Arsenic poisoning. (See Lecture Notes.) *from wallpaper - in sweets, in dyed clothing*
48. Does Arsenic produce any symptoms other than those of an irritant poison? What? (P. 378) *cramps in calves of legs.*
49. What are the cardinal symptoms of arsenic poisoning? (See Lecture Notes.) *int. pain water stool, - faint, vomiting, abd. pain*
50. Name some diseases that are similar to chronic arsenical poisoning. (See Lecture Notes.)
51. Why are puffy eyelids present in both acute and chronic arsenical poisoning? (See Lecture Notes.)
52. What is the standard official antidote for arsenical poisoning? (P. 379) *FeO₄*
53. Which salt of Mercury is the most common source of poisoning? *Bichloride of Mercury*
54. How long would you expect a person to live who was suffering from acute corrosive sublimate poisoning? (See Lecture Notes.) *1 hr. to 2 wks.*
55. What pathological condition usually causes death in corrosive sublimate poisoning? (See Lecture Notes.) *ulcers of mouth, throat, & stomach*
56. What form of poisoning causes chronic salivation? (P. 382) *Mercuric -*
57. What is sugar of lead? (P. 383) *Lead Acetate Pb(C₂H₃O₂)₂*
58. What antidote is the best in a case of poisoning from sugar of lead? (P. 385) *by SO₂ or H₂SO₄ - a little of the salt (1)*
59. Give five possible sources of chronic lead poisoning? (P. 384-385)
60. What is "lead palsy"? (P. 385) *paralysis in lead poisoning*
61. By what symptoms would you expect to recognize a case of chronic lead poisoning? (P. 385) *blue white gums, anemic, weakness, constipation, etc.*
62. Give four cardinal symptoms of chronic lead poisoning. (P. 385) *blue white gums, anemic, weakness, constipation, etc.*
63. Give the adjustments for irritant poisons. (See Lecture Notes.) *Keep stool for any poisons*
64. What class of poisons affect primarily the nervous system? (P. 389) *Narcotics*
65. Name a narcotic poison. (P. 389) *Opium*
66. What is the principal alkaloid of Nux Vomica? (P. 396) *181, 182, 183
Nuxine & Strychnine*

67. What is the physiological action of Strychnine? (See Lecture Notes.)
68. What poison is often obtained from fruit pits? (See Lecture Notes.)
69. What is the name of the compound formed by the union of carbon monoxid and blood? (P. 405)
70. Name two poisons that produce methemoglobin. (P. 404)
71. What is the best antidote for bee stings? (P. 406)
72. What poison usually causes blindness? (See Lecture Notes.)
73. How would you distinguish between acute alcohol poisoning and an epileptic coma? (P. 392, and Symptomatology.)
74. Name some poisons that produce skin lesions.
75. What poison produces jaundice? (P. 376) *Phosphorus*
76. What class of compounds do ptomaines resemble? (See Lecture Notes.)
77. From what are ptomaines obtained? (See Lecture Notes.)
78. What are the nature of the symptoms of ptomaine poisoning and where would you adjust? (See Lecture Notes.)
79. Describe a case of chronic lead poisoning. (P. 385)
80. Describe a case of strychnine poisoning and tell what you would do for relief. (P. 397)

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